APPLIED GEOSTATISTICS FOR RESERVOIR MODELING & CHARACTERIZATION

Select appropriate reservoir characterization and geostatistical tools to better generate reservoir models

10th AUGUST 2015 - 14th AUGUST at Ho Chi Minh, Vietnam

PetroSync Distinguished Instructor:
DR. RICHARD CHAMBERS
INDEPENDENT CONSULTANT

- Over 40 years of experience in quantitative data analysis and computer modeling in geoscience. He is a notable expert with broad expertise in data analysis, mathematical geology, reservoir characterization, and geostatistical modeling in the petroleum. Richard has trained more than 4000 people in the use of geostatistical methods in reservoir modeling
- Designed Earth Modeling Software for Landmark, Halliburton, and has co-Aauthored over two dozen of patents while in Halliburton
- Worked on major oil fields worldwide (USA, Mexico, UK, Norway, Russia, Kuwait, Brazil, Venezuela, Colombia, Ecuador, Argentina, India, Canada, Egypt, Nigeria, Gulf of Thailand, for example)
- Author and co-author of more than 60 scientific papers and technical articles. Two of his co-authored articles were awarded best paper of the year in the Journal of Great Lakes Research (1985) and the SEG journal (1996)
- Past Chairman of AAPG Reservoir Development Committee

Course Objectives

- Understand the underlying application of geostatistics to reservoir modeling
- Identify when and where to apply reservoir description and modeling to support reservoir management
- Understand the limitations and opportunities for reservoir modeling, and select the appropriate reservoir characterization and geostatistical modeling tools
- Apply probability and statistical tools in exploratory data analysis and geostatistical modeling
- Analyze and QC data for static modeling through analysis of variograms and spatial continuity
- Perform kriging and stochastic simulations
- Understand principles of upsampling of reservoir models
- Comprehend the methodology of integrated studies
- Gain familiarity with workflow for uncertainty analysis
- Recognize current level of technology for reservoir characterization

Specially Designed for

Geophysicists
Geologists & Geoscientists
Reservoir Engineers
Geomodellers

This course is intended for geologists, geoscientists and engineers who need to know the application of Geostatistics for reservoir characterization and Static modeling; the need to build static models to support reservoir management. This course is also suitable for managers and supervisors who wish to update their skills and to be aware of the current level of technology available for reservoir characterization and management.

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This course addresses the practical aspects of reservoir characterization using geostatistical modeling methodologies. First, it focuses on classical statistical data analysis followed by a discussion on the concepts of spatial statistics and geostatistical principles and finally finishing with a discussion on engineering principles related to fluid flow simulation. The practical basis and decision criteria for kriging and conditional simulation methods are presented in detail, minimizing mathematical discussions. Useful workflows for ranking and uncertainty analysis are presented followed by a discussion of upscaling implications and methodologies.

After attending this program, attendees will gain a better understanding of basic data analysis, geostatistical modeling concepts, and software parameterization for reservoir modeling. It is intended for petroleum geologists, geophysicists, and engineers who wish to gain a better appreciation for each other’s disciplines. Case studies are presented at appropriate places during the week.

I. GEOLOGICAL CHARACTERIZATION FOR RESERVOIR MODELING
- Review of the Fundamentals of the Reservoir Characterization and Modeling Processes
- Compare and Contrast of the Traditional Approach to Reservoir Model Development with a Geostatistical Approach
- Generalized Reservoir Characterization Workflow
- Five major Elements in Creating a Numerical Flow Simulation Model using Geostatistical Methods

II. DATA QUALITY CONTROL AND DATA ANALYSIS
- Common Data Quality Control
- Data Analysis Tools
- Quality Control Methodologies
- Computation of Classical Statistical Measures
- Use of Graphical Data Representations to Understand the Nature of their Datasets

III. CONCEPTS OF SPATIAL ANALYSIS AND MODELING
- Spatial Aspects of the Datasets
- Consideration and Analysis of the Degree of Continuity
- Directionality when Developing a Reservoir Model
- Applied Geostatistics (Spatial Statistics)
- Concepts of Spatial Statistics, Variogram Computation, and Modeling

IV. PRINCIPLES OF KRIGING AND COLLOCATED CKRIGING
- Fundamentals of Geostatistical Interpolation Methods (Kriging and Collocated Co-Kriging)
- Application to Distribution of Facies and Petrophysical Properties within the Reservoir Model
- Demystification of Variograms, Kriging Algorithms, and Multivariate Counterparts
V. PRINCIPLES OF STOCHASTIC SIMULATION AND UNCERTAINTY ANALYSIS

- Geostatistical Simulation Methods Strive to Preserve Realistic Reservoir Heterogeneity
- Calculating many Equally Probable Solutions, called Realizations (Stochastic Approach)
- Commonly used Algorithms (SGS and Turning Bands for General Property Modeling)
- Facies Modeling Algorithms (SIS, TGS, PGS and Object Modeling)
- Quantification, Assessment, and Analysis of Realizations to Model Uncertainty
- Stochastic Simulation, Uncertainty Assessment, and Risk Analysis of Stochastic Models

VI. PUTTING IT ALL TOGETHER: CREATING THE HIGH-RESOLUTION 3D STATIC RESERVOIR MODEL

- Structural Model forms the Gross Framework of the Reservoir (Major Reservoir Horizons and Faults)
- Surface Definition for the Sequence Stratigraphic Framework of the Model
- Fault model as an Integral Part of the Structural Model
- Two Primary Elements of Sedimentary Model
- Definition of the Internal Stratigraphic Layering (Bedding Geometry)
- Distribution of the Facies within the Structural and Stratigraphic Framework
- Key Principle - Sedimentary Model must be defined in terms of sequence stratigraphy, or in logical "bundles" of stratigraphic units that are related to depositional processes
- After Facies modeling, the petrophysical properties (porosity, permeability, Sw) are assigned on a facies-by-facies basis, using the sedimentary model as a template

VIII. UPSCALING FOR THE FLOW SIMULATOR

- High-Resolution Geologic Model typically is too fine scale for the flow simulator and must be upcaled before dynamic simulation. An overview of simulation ranking and upscaling methods will be analyzed

IX. UPSCALING EXERCISE USING EXCEL/CALCULATOR

- Hands on upscaling exercise to investigate the impact of heterogeneity and the upscaling methodology.

PROGRAM SCHEDULE

<table>
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<tr>
<th>Time</th>
<th>Activity</th>
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<tr>
<td>08:00 – 09:00</td>
<td>Registration (Day1)</td>
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<td>09:00 – 11:00</td>
<td>Session I</td>
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<td>11:00 – 11:15</td>
<td>Refreshment &amp; Networking Session I</td>
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<td>11:15 – 13:00</td>
<td>Session II</td>
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<td>13:00 – 14:00</td>
<td>Lunch</td>
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<td>14:00 – 15:30</td>
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<td>15:30 – 15:45</td>
<td>Refreshment &amp; Networking Session II</td>
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<td>15:45 – 17:00</td>
<td>Session IV</td>
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Dr. Chambers has more than 40 years of experience in quantitative data analysis and computer modeling in the geosciences. He is a noted expert with broad expertise in data analysis, mathematical geology, reservoir characterization, and geostatistical modeling in the petroleum, mining, environmental, and cellular telecommunications industries.

His petroleum industry experience includes such areas as applied research in P- and S-Wave seismic acquisition, processing, and interpretation. For nearly three decades now, he has worked in the area of data integration applying geostatistical methods in reservoir characterization projects.

Typical studies include prediction of reservoir properties from seismic attributes, volumetric determination, and depth conversion, 3D velocity models for pre-stack depth migration, prediction of basin temperature, reservoir pressure prediction, and risk assessment.

Two of his co-authored articles were awarded best paper of the year in the Journal of Great Lakes Research (1985) and the SEG journal (1996). He is co-editor, with Dr. Jeffrey Yarus, of Stochastic Modeling and Geostatistics, AAPG Computer Applications in Geology, No. 3 and No. 5. Rich is formerly the Chief Product Manager in the Software and Asset Solution Product Service Line of Halliburton with the responsibility of providing technical guidance for the development of earth modeling software based on geostatistical technologies.

His professional activities include publishing, designing earth modeling software, consulting, lecturing and offering applied training courses. He was the past Chairman of the AAPG Reservoir Development Committee. Dr. Chambers has co-authored about two dozen patents while at Halliburton. Rich has also authored or co-authored more than 60 scientific papers and technical articles.

**HONORS & RECOGNITION:**
- 2009: Nominated Employee of the Year at Landmark GGT
- 1996: SEG Journal: Best Paper of the Year
- 1995: Amoco Outstanding Performance Award
- 1985: Journal Great Lakes Research: Best Paper of the Year
- 1970: National Science Foundation Scholarship (Juneau Icefield Research Program)

**Memberships:**
- American Association of Petroleum Geologists (AAPG)
- Society of Exploration Geophysicists (SEG)
## Course Details

**Title:** APPLIED GEOSTATISTICS FOR RESERVOIR MODELING & CHARACTERIZATION  
**Date:** 10th - 14th August 2015  
**Location:** HO CHI MINH, VIETNAM

### Investment Packages

<table>
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<th>Investment Package</th>
<th>Deadline</th>
<th>Price</th>
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<tr>
<td>Standard Price</td>
<td>7th AUG 2015</td>
<td>USD $ 4,295</td>
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<tr>
<td>Early Bird Offer</td>
<td>10th JUL 2015</td>
<td>USD $ 4,095</td>
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<tr>
<td>Group Discount (3 or more Delegates)</td>
<td>7th AUG 2015</td>
<td>10% discount for groups of 3 registering from the same organization at the same time</td>
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Group Discount is based on Standard Price

* To enjoy the promotion & discount offer, payment must be made before deadline  
* For 7 or more delegates, please inquire for more attractive package.  
* Prices include lunches, refreshments and materials. Promotion & discount cannot be combined with other promotional offers.  
* Important: Please note that registration without payment will incur a SGD 200 administration fee.

### Delegates Details

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### Invoice Details

**Attention Invoice to:**  
**Direct Line Number:** | **Fax:**  
**Company:** | **Email:**  
**Address:** | **Postcode:**  
**Country:** | **Email:**  
**Please note:**  
- Indicate if you have already registered by Phone  
- Fax | Email | Web  
- If you have not received an acknowledgement before the training, please call us to confirm your booking.

### Payment Methods

- **By Credit Card:** Please debit my credit card:  
  - Visa  
  - MasterCard  
  - AMEX  
  - Security Code:  
  - Card Number:  
  - Expiry Date:  
  - Name printed on card:

- **By Direct Transfer:** Please quote invoice number(s) on remittance advice  
  - PetroSync Global Pte Ltd Bank details:  
  - Account Name: PetroSync Global Pte Ltd  
  - Bank Name: DBS Bank Ltd  
  - Bank Code: 7171  
  - Bank Swift Code: DBSSSGSGXX  
  - Branch code: 288  
  - Account No.: SGD: 2889018980  
  - USD: 0288002682016  
  - Bank Address: 12 Marina Boulevard, Level 3, Marina Bay Financial Centre Tower 3. Singapore 018982  
  - All bank charges to be borne by payer. Please ensure that PetroSync LLP receives the full invoiced amount.

## Programme Consultant

**Name:** Cay Aagen  
**Email:** registration@petrosync.com  
**Phone:** +65 6415 4500  
**Fax:** +65 6826 4322

### Terms and Conditions

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Please note that trainers and topics were confirmed at the time of publishing; however, PetroSync may necessitate substitutions, alterations or cancellations of the trainers or topics. As such, PetroSync reserves the right to change or cancel any part of its published programme due to unforeseen circumstances. Any substitutions or alterations will be updated on our web page as soon as possible.

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### Cancellation Policy

You may substitute delegates at any time as long as reasonable advance notice is given to PetroSync. For any cancellation received in writing not less than fourteen (14) working days prior to the training course, you will receive credit voucher less a SGD $200 administration fee and any related bank or credit card charges.

Delegates who cancel less than fourteen (14) working days of the training course, or who do not attend the course, are liable to pay the full course fee and no refunds will be granted.

In the event that PetroSync cancels or postpones an event for any reason and that the delegate is unable or unwilling to attend in the rescheduled date, you will receive a credit voucher for 100% of the contract fee paid. You may use this credit voucher for another PetroSync course, which must occur within a year from the date of postponement.

PetroSync is not responsible for any loss or damage as a result of the cancellation policy. PetroSync will assume no liability whatsoever in the event this event is cancelled, rescheduled or postponed due to any Act of God, fire, act of government or state, war, civil commotion, insurrection, embargo, industrial action, or any other reason beyond management control.

### Certificate of Attendance

**70% Attendance is Required for Issuance of PetroSync’s Certificate.**

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### Charges & Fee(s)

- For Payment by Direct Telegraphic Transfer, client has to bear both local and overseas bank charges.  
- For credit card payment, there is additional 4% credit card processing fee.

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**Course Confirmation**

I agree to PetroSync’s terms & conditions, payment terms and cancellation policy.

**Authorized Signature:**

**Payment Terms:** Payment is due in full at the time of registration. Full payment is mandatory for event attendance.